

8. (a) Apply Gauss Elimination method to solve the equations :

$$x + 4y - z = -5, \quad x + y - 6z = -12,$$

$$3x - y - z = 4. \quad 10$$

- (b) Find the root of the equation $x^3 - 4x - 9 = 0$, using the bisection method in four stages. 10

Exam. Code : 209001

Subject Code : 4871

M.Sc. Physics 1st Semester (Batch 2021-23)

COMPUTATIONAL TECHNIQUES

Paper—PHY-404

Time Allowed—3 Hours]

[Maximum Marks—100

Note :— Attempt FIVE questions in all, selecting at least ONE question from each section. The fifth question may be attempted from any section. All questions carry equal marks.

SECTION—A

- (a) What is the difference between a script file and a data file ? What are the other types of files in MATLAB ? 10
- (b) Write a program to plot the curve given by equation $y = \sin(x)$, as x varies from 0 to 2π . Also label the x - and y - axis and provide a suitable title to the plot. 10
- (a) Discuss in detail the major components of the MATLAB environment. 10

- (b) Write a MATLAB program to find the length of the third side and area of the triangle, if two sides $a = 3.2$ and $b = 4.6$ of triangle and angle $\theta = 60^\circ$ between these sides. 10

SECTION—B

3. (a) The following table gives the population of a town during the last six censuses. Compute the population in the year 1978 using Newton's interpolation technique :

Year (x)	Population (y) (in thousands)
1970	7
1975	11
1980	14
1985	18
1990	24
1995	32

- (b) By means of Lagrange's formula, prove that :

$$y_0 = \frac{1}{2}(y_1 + y_{-1}) - \frac{1}{8} \left[\frac{1}{2}(y_3 - y_1) - \frac{1}{2}(y_{-1} - y_{-3}) \right].$$

10

4. (a) Show that the divided differences are symmetrical in their arguments i.e. independent of the order of the arguments. 10
- (b) Using Newton's divided difference formula, prove that :

$$f(x) = f(0) + x\Delta f(-1) + \frac{(x+1)x}{2!} \Delta^2 f(-1) +$$

$$\frac{(x+1)x(x-1)}{3!} \Delta^3 f(-2). \quad 10$$

SECTION—C

5. Derive General Quadrature formula for equidistant ordinates. Also, find out the Simpson's one-third and three-eighths rules from the General Quadrature formula. 20
6. (a) Explain working of Monte-Carlo method. 10
- (b) Using modified Euler's method, find an approximate value of y when $x = 0.3$, given that $\frac{dy}{dx} = x + y$ and $y = 1$, when $x = 0$. 10

SECTION—D

7. Explain the working of Newton-Raphson Method in detail. Also discuss its convergence. 20